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ARTIKEL PENELITIAN

Correlation Of Neutrophil Lymphocyte Ratio And Platelet Lymphocyte Ratio With Severity Of COVID-19

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Abstrak

Tujuan: Pemeriksaan *neutrophil-to-lymphocyte ratio* (NLR) dan *platelet-to-lymphocyte ratio* (PLR) adalah pemeriksaan sederhana yang dapat dilakukan sebelum pasien COVID-19 dirawat inap. Pemeriksaan ini berguna untuk menentukan diagnostik dan prognostik pasien. Tujuan penelitian adalah untuk menentukan hubungan NLR dan PLR dengan tingkat keparahan pasien rawat inap COVID-19; **Metode:** Penelitian ini merupakan penelitian analitik dengan pendekatan *cross-sectional* menggunakan data sekunder dari 289 rekam medik pasien yang terkonfirmasi COVID-19 periode Juni-Agustus 2021. Dalam pengambilan sampel, digunakan teknik *total sampling* lalu diolah dengan uji *chi-square*; **Hasil:** Subjek penelitian terbanyak berada pada rentang 26-45 tahun (28,4%). Lebih dari setengah subjek berjenis kelamin perempuan (61,6%). Ditemukan sebanyak 99 orang pasien (34,3%) dengan kondisi parah. Kurang dari separuh pasien dengan hasil pemeriksaan leukosit dan trombosit yang tidak normal yaitu 64 (22,1%) dan 56 (19,4%). Pasien dengan pemeriksaan NLR dan PLR yang tidak normal sebanyak 135 (46,7%) dan 123 (42,6%). Terdapat hubungan yang bermakna antara NLR dengan tingkat keparahan pasien rawat inap COVID-19 (p<0,001, OR=9,452). Terdapat hubungan yang bermakna antara PLR dengan tingkat keparahan pasien rawat inap COVID-19 (p<0,001, OR=7,268); **Kesimpulan:** Terdapat hubungan yang signifikan antara NLR dan PLR dengan tingkat keparahan pasien rawat inap COVID-19 di Rumah Sakit Universitas Andalas.
Kata kunci: COVID-19; RNL; RTL; tingkat keparahan.

Abstract

Objective: The neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) tests are simple tests can be done before a COVID-19 patient hospitalized. This examination is useful for determining the diagnosis and prognostic of the patient. The aim of the study was to determine the correlation between NLR and PLR with the severity of COVID-19; **Method:** This research was an analytical study with a cross-sectional approach using secondary data from 289 medical records of patients with confirmed COVID-19 for the period June-August 2021. The total sampling technique was used and processed with the chi-square test; **Result:** Most of the research subjects were in the range of 26-45 years (28.4%). More than half of the subjects were female (61.6%). There were 99 patients (34.3%) with severe conditions. Less than half of the patients had abnormal leukocyte and platelet examination results, namely 64 (22.1%) and 56 (19.4%). Patients with abnormal NLR and PLR examinations were

135 (46.7%) and 123 (42.6%). There was a significant correlation between NLR and the severity of COVID-19 inpatients (p<0.001, OR=9.452). There is a significant correlation between PLR and the severity of COVID-19 inpatients (p<0.001, OR=7.268); **Conclusion:** This study concludes a significant correlation between NLR and PLR with the severity of COVID-19.
Keywords: COVID-19; NLR; PLR; severity

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) is a collection of various clinical symptoms ranging from mild respiratory symptoms to severe and life-threatening pneumonia caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and contagious.[1] Diagnosis of COVID-19 is classified based on clinical symptoms, namely mild, moderate, severe and critical. Most of the patients with COVID-19 have mild symptoms such as experiencing low-grade fever, fatigue, and no pneumonia, and without any radiological found. Moderate patients have symptoms similar to mild patients with features of pneumonia. In patients with severe and critical symptoms, it can quickly develop into Acute Respiratory Distress Syndrome (ARDS), Multi Organ Failure (MOF), and can even cause death.[2]

The pathogenesis of SARS-CoV-2 is still not known with certainty, but it is not much different from SARS-CoV. This virus primarily infects the cells lining the alveoli in the respiratory tract. The SARS-CoV-2 virus makes its way into host cells by binding to receptors on cells. Protein S in the viral envelope will bind to cell receptors, namely Angiotensin-Converting Enzym 2 (ACE2). The SARS-CoV-2 virus enters host cells mediated by increased viral uptake by Type 2 Transmembrane Serineprotease (TMPRSS2) in host cells which breaks down ACE2 and activates protein S. Type 2 Transmembrane Serineprotease (TMPRRS2) and ACE2 are expressed mainly in the lung as type 2 pneumocytes. Inside the cell, SARS-CoV-2 performs transcription of genetic material and protein translation which will later be used to make new virions. The viral RNA genome will be released into the cytoplasm and a translation process will occur which will produce two polyproteins and a structural protein. The next process is replication. The newly formed glycoprotein passes into the endoplasmic reticulum. The nucleocapsid will be formed from the arrangement of the nucleocapsid RNA genome and proteins. Growth of virus particles occurs in the endoplasmic reticulum and golgi cells. Vesicles that already contain virus particles fuse with the plasma membrane which will release new virus.[3]

The severity of SARS-CoV-2 infection is determined by the cytopathic effect of the virus and its ability to overcome host cell immunity. Immune

system dysregulation plays a role in tissue damage. Excessive immune response can cause tissue damage. On the other hand, an inadequate immune response allows the virus to replicate and damage tissues.[4] The innate immune response to respiratory infections such as SARS-CoV-2 is characterized by neutrophils entering the lungs, especially in the alveoli. Increased neutrophil infiltration leads to collateral tissue damage, vascular stasis, and cytotoxicity.[5]

In patients with critical degrees of COVID-19, immune cells infiltrate the lungs and cause infection in the lungs with a pathogenesis that cannot be explained. The immune response created by the lymphocytes is triggered by the virus. Systemic infection suppresses cellular immunity. SARS-CoV-2 mainly acts on lymphocytes, especially T lymphocytes. Total lymphocytes, CD4+ T cells, CD8+ T cells, B cells, and NK cells decrease in COVID-19 patients, and in severe cases these cells are found to be lower than mild cases.[6]

Neutrophil lymphocyte ratio (NLR) is a simple marker of inflammation. The significance of NLR can be seen in bacterial pneumonia. NLR examination is also considered easier and cheaper. The NLR calculation is obtained from a comparison of the absolute neutrophil count and absolute lymphocyte count.[7] It is known that the normal value of NLR in adults, non-geriatrics, and populations with good health conditions is 0.78-3.53.[8] Based on the research of Eid *et al.* The sensitivity and specificity of NLR vary based on age and the level of NLR obtained. When the patient is > 50 years old and the NLR level is ≥ 3.1, a sensitivity of 95.24% and a specificity of 92.86% is obtained which indicates that the patient needs treatment in the ICU. When the patient was < 50 years old with NLR level ≥ 4.21, the sensitivity was 70.3% and the specificity was 93.7%.[9]

Neutrophil Lymphocyte Ratio (NLR) is a prognostic factor for endotracheal intubation and an independent predictor of the risk of death in COVID-19 patients.[10] NLR examination has been studied as a predictor of bacterial infections including pneumonia. The NLR value was found to be increased in patients with severe and critical COVID-19 conditions. An increase in the number of neutrophils indicates an inflammatory response and a decrease in the number of lymphocytes indicates damage to the immune system in COVID-

19 patients.[11] SARS-CoV-2 mainly attacks lymphocytes, especially T lymphocytes, so that patients are found to have lymphopenia. Inflammation-related lymphopenia will increase NLR in COVID-19 patients.[6]

Neutrophils are very important in the innate immune response while lymphocytes have a role in the inflammatory response. In COVID-19 patients, high levels of circulating neutrophils are found in the blood. Therefore, an increase in NLR reflects an imbalance in the inflammatory response and is considered an indicator of a patient progressing to severe disease. Increased NLR is associated with mortality in patients with severe sepsis and septic shock. Increased NLR is also associated with mortality in patients with comorbid cardiovascular disease. The mechanism occurs because inflammatory mediators from neutrophils cause degeneration of blood vessel walls while lymphocytes play a role in anti-atherosclerosis. NLR imbalance on hematological examination also indicates the development of the disease in a more severe direction and has a risk of complications such as ARDS, sepsis, and MODS. NLR examination is also assessed as a marker of chronic inflammation.[12] Patients who have higher NLR values have a higher risk of death during hospitalization. NLR examination can be done early on admission so that doctors can identify patients who have a risk of becoming critical so that the management of patients with increased NLR can be modified according to disease criteria. From this explanation, an increase NLR in COVID-19 patients can be used as a marker to assess the patient's prognosis and severity.[7]

Platelet lymphocyte ratio (PLR) is a new marker of inflammation which is inexpensive and available in the clinical setting. The reference interval for PLR values in healthy adults (18-64 years) is 49-198 and in older adults (65-79 years) is 42-187.[13] PLR as a non-specific marker of inflammation implies an interaction between the platelet count and lymphocyte count which can reflect aggregation as well as inflammatory pathways.[14] The sensitivity and specificity of the PLR examination were 100% and 81.5%.[15]

In patients with severe cases found increased PLR values. An increase in PLR is also related to the patient's length of stay

in the hospital. If during treatment an increase in PLR is found more frequently, the patient will be treated longer and the possibility of severe pneumonia is greater. Patients who are found to have less increase in PLR values during treatment will have a shorter length of stay. Research conducted by Qu *et al.* found that the platelet count increased first then decreased in critically ill patients. The occurrence of thrombocytopenia in this severe patient is hematopoietic inhibition by SARS-CoV-2 because it directly attacks hematopoietic cells or stromal cells in the bone marrow. Another cause is extensive alveolar damage due to SARS-CoV-2 infection which causes injury to lung tissue and lung endothelial cells. The result is decreased platelet production because the lung is one of the organs where mature megakaryocytes release platelets. Injury to lung tissue can lead to activation, aggregation, retention of platelets in the lung, and thrombus formation at the site of injury leading to increased platelet consumption and depletion of platelets and megakaryocytes.[15] The increase in PLR at the start of admission greatly affects the mortality and morbidity of COVID-19 patients. PLR examination is an excellent marker for determining the prognosis of COVID-19 patients on the grounds that PLR is a marker of stable inflammation; PLR assays are sensitive to innate and acquired immune responses; PLR is an examination that is simple, cheap, and available in various health facilities.[14]

METHODS

This research was performed at Andalas University Hospital in June-August 2021. This research was a cross-sectional study using data from the patient medical record. The parameter in this study including the number of medical record, age, sex, severity, RT-PCR result, hematology laboratory profile (leukocyte, thrombocyte, leukocyte count: neutrophil, lymphocyte). Inclusion criteria were patients with confirmed COVID-19 and with complete laboratory data. This research was approved by The Research Ethics Committee of Medical Faculty Andalas University with number 996/UN.16.2/KEP-FK/2022.

This study selected 289 inpatient COVID-19 cases who were RT-PCR positive. Categorical data were represented in the form of frequency and percentage. Quantitative data were defined as mean and standard deviation. A value of $p<0,05$ was considered statistically significant.

Computer software was used for analyzing the data.

RESULT AND DISCUSSION

In June-August 2021, 434 patients with positive RT-PCR test were found. A total of 145 patients were exluded from the analysis. In this study, 289 subjects met the inclusion and exclusion criteria. The characteristics of the study subject can be seen in Table 1.

Table 1. Characteristics of study subjects

Variable	Number (%)
Age (years old)	
< 17	8 (2.8)
17 – 25	34 (11.8)
26 – 45	82 (28.4)
46 – 55	41 (14.2)
56 – 65	72 (24.9)
> 65	52 (18)
Gender	
Male	111 (38.4)
Female	178 (61.6)
Leukocyte	
Leukopenia	14 (4.8)
Normal	225 (77.9)
Leukocytosis	50 (17.3)
Thrombocyte	
Thrombocytopenia	47 (16.3)
Normal	223 (80.6)
Thrombocytosis	9 (3.1)

There were 111 male patients (38.4%) and 178 female patients (61.6%) involved in this study. This finding is different from several studies by Zhang *et al.* who conducted a study of 140 COVID-19 patients and found that 71 people (50.7%) were men. Compared to women, men have a higher risk of infection. The natural and adaptive immune response in women is stronger than in men. This makes women less susceptible to various infections, whether caused by fungi, bacteria, parasites or viruses.[16] Study by Aryani and Pramatik showed that were 46 male (54.8%) and 38 female (45.2%).[17] Research conducted by Jin *et al.* found that the receptor cells attacked by both SARS-CoV-2 and SARS-CoV were the same, namely ACE2. Certain organ failures occur as a result of increased expression of the ACE2 receptor protein. ACE2 levels have been shown to be higher circulating in males than females. As a result of these higher levels, the clinical parameters in males are found to be more severe than in females.[18]

The mean age of all subject was 47.45±18.76 years. The age group 26 − 45 years is the largest age group with a total of 82 people, followed by the age group 56 − 65 years with 72 people, the age group > 65 with 52 people, the age group 46 – 55 years with 41 people, the age group 17 – 25 years as many as 34 people, and the age group <17 as many as 8 people. Study by Grasseli *et al.* study conducted in the ICU area of Lombardy, Italy found that the average patient age was 63 years (56-70 years) out of 1591 critical COVID-19 patients.[19] Zhang *et al*. obtained from his research that

the average number of COVID-19 patients who were research subjects was 57 years old with an age range of 25-87 years, where the majority of patients (70%) were > 50 years old.[16]

Patients were grouped into three groups, namely the group with normal examination results, leukopenia, and leukocytosis. There were 225 patients (77.9%) with normal results, which made up more than half of the patients, who obtained normal leukocyte examination results, while 64 other people found abnormal results, where 14 patients (4.8%) with leukopenia and 50 subjects (17.3%) had leukocytosis. This is in line with the research of Zhao *et al*. who studied 612 COVID-19 patients, found 52 patients had increased leukocytes. This increase is in line with the age of patients who are getting older and patients who have comorbidities.[20] Research by Dawood *et al*. found 11 subjects (9.82%) had leukocytosis while 6 subjects (5.4%) had leukopenia.[21] High levels of circulating neutrophils were found in COVID-19 patients.[12] This indicates an inflammatory response which indicates damage to the immune system of COVID-19 patients.[11]

The results of the platelet examination showed that there were patients with higher normal results, namely 233 people (80,6%), compared to 56 people with abnormal results. In the abnormal results, the subjects were divided into thrombocytopenia, totalling 47 people (16,3%) and thrombocytosis, 9 people (3,1%). Research by Dawood *et al*. out of 112 randomly selected samples, 6 patients (5.4%) had thrombocytopenia and 7 patients (6.25%) had thrombocytosis.[21] Qu *et al*. found that critical patients will initially experience an increase in platelet examination results, then along with the severity that occurs, their platelets will decrease. SARS-CoV-2 attacks directly on hematopoietic cells in the bone marrow resulting in inhibition of the hematopoietic process. Alveolar damage also causes lung tissue injury which results in decreased platelet production.[15]

Table 2. Bivariate analysis

Variable	P Value	OR
NLR	< 0.001	9.452
PLR	< 0.001	7.268

Based on the data analysis test using the chi-square test, the value of p <0.001 was obtained. This shows that there is a significant correlation between NLR and PLR with the severity of COVID-19 inpatients at Unand Hospital. It can be concluded that there is a correlation

between NLR and PLR with the severity of COVID-19.

This research is in line with the study conducted by Liu *et al*. This study involved 245 COVID-19 patients who stated that there was a significant relationship between NLR and an increased risk of death during hospitalization.[7] Other studies state that the finding of NLR tends to be higher in patients with severe infectious conditions.[11] Higher NLR examination results are the result of an increase in the number of neutrophils and a decrease in the number of lymphocytes. This increase in NLR is influenced by the inflammatory response which causes an increase in neutrophil production and accelerates lymphocyte apoptosis. NLR elevation is an independent prognostic biomarker for COVID-19 patients.[22] Increase NLR can be used as a biomarker for the risk factor of COVID-19.[17]

This is in line with study conducted by Qu et al which found that there was a relationship between increased PLR and the severity of COVID-19 patients. There was an increase in PLR in the severe group. In addition, an increased PLR was also found in patients who had a longer average hospital stay. PLR examination is useful as a marker of inflammation in various diseases to predict inflammation and death. Increased PLR is strongly associated with long-term mortality.[15] Chan and Rout in their research concluded that the PLR examination can be used as an independent prognostic to differentiate patients with moderate and severe conditions. In severe patients, an increase in PLR will be found, while in non-severe patients, an average stable PLR value will be found.[23]

Table of Correlation NLR and severity of COVID-19 inpatients at Andalas University Hospital

Variable	Severity				P value
	Nonsevere		Severe		
	f	%	f	%	
NLR					
≤ 3,53	134	70,5	20	20,2	
> 3,53	56	29,5	79	79,8	0,000
Total	190	100	99	100	

Table of Correlation NLR and severity of COVID-19 inpatients at Andalas University Hospital

Variable	Severity				P value
	Nonsevere		Severe		
	f	%	f	%	
PLR					
≤ 180	139	73,2	27	27,3	
> 180	51	26,8	72	72,7	0,000
Total	190	100	99	100	

Master Table

NO	INITIAL	AGE	GENDER	LEUKOCYTE	NEUTROPHYL	THROMBOCYTE	LIMPHOCYTE	NLR	PLR	SEVERITY
1	AR	22	FEMALE	4800	0,33	200000	1584	1,48	126,26	NONSEVERE
2	A	68	FEMALE	18400	0,02	373000	368	46	1013,59	SEVERE
3	BA	26	FEMALE	7600	0,28	300000	2128	2,29	140,98	NONSEVERE
4	D	66	FEMALE	16800	0,04	191000	672	22	284,23	SEVERE
5	DL	27	FEMALE	5700	0,45	286000	2565	1	111,5	NONSEVERE
6	ES	56	FEMALE	8400	0,38	362000	3192	1,37	113,41	SEVERE
7	ES	29	MALE	7500	0,34	247000	2550	1,74	96,86	NONSEVERE
8	E	62	MALE	7000	0,23	413000	1610	3,04	256,52	NONSEVERE
9	E	58	MALE	3700	0,44	110000	1628	1,07	67,57	NONSEVERE
10	EL	52	FEMALE	4300	0,23	172000	989	2,87	173,92	NONSEVERE
11	FA	18	MALE	11600	0,07	238000	812	12,14	293,1	NONSEVERE
12	FA	23	FEMALE	5600	0,34	321000	1904	1,62	168,59	NONSEVERE
13	G	27	FEMALE	6300	0,32	205000	2016	1,78	101,69	NONSEVERE
14	AR	73	MALE	12710	0,19	231000	2414,9	3,58	95,66	NONSEVERE
15	HI	30	MALE	4500	0,2	84000	900	3,5	93,33	NONSEVERE
16	E	64	FEMALE	11070	0,11	235000	1217,7	7,27	192,99	SEVERE
17	IY	73	MALE	3800	0,05	173000	190	18	910,53	NONSEVERE
18	IJ	62	MALE	6900	0,2	165000	1380	3,5	119,57	SEVERE
19	J	54	MALE	9900	0,16	442000	1584	4,69	279,04	SEVERE
20	J	70	FEMALE	10100	0,17	194000	1717	4,18	112,99	NONSEVERE
21	KP	21	FEMALE	7400	0,2	252000	1480	3,5	170,27	NONSEVERE
22	LH	52	FEMALE	4000	0,2	152000	800	3,35	190	NONSEVERE
23	LH	24	MALE	9000	0,34	262000	3060	1,76	85,62	NONSEVERE
24	MB	24	MALE	9000	0,21	202000	1890	3,33	106,88	NONSEVERE
25	MY	53	MALE	11000	0,04	263000	440	21,25	597,73	SEVERE

26	M	63	MALE	4200	0,1	230000	420	7,4	547,62	SEVERE
27	MR	25	FEMALE	8500	0,17	226000	1445	4,29	156,4	NONSEVERE
28	MD	2	MALE	15000	0,27	224000	4050	2,52	55,31	SEVERE
29	M	42	MALE	11100	0,18	435000	1998	4,61	217,72	SEVERE
30	NP	26	FEMALE	8200	0,25	448000	2050	2,6	218,54	NONSEVERE
31	NS	29	FEMALE	8400	0,31	156000	2604	2	59,91	NONSEVERE
32	NS	26	FEMALE	10400	0,24	160000	2496	2,75	64,1	NONSEVERE
33	N	63	FEMALE	5500	0,22	258000	1210	2,95	213,22	NONSEVERE
34	NA	21	FEMALE	3000	0,56	148000	1680	0,54	88,1	NONSEVERE
35	PB	27	MALE	8700	0,05	273000	435	17,4	627,59	NONSEVERE
36	RR	22	FEMALE	3800	0,51	234000	1938	0,71	120,74	NONSEVERE
37	RC	27	MALE	4900	0,45	190000	2205	1	86,17	NONSEVERE
38	SG	32	FEMALE	7800	0,18	192000	1404	3,89	136,75	NONSEVERE
39	SA	71	FEMALE	2100	0,6	214000	1260	0,33	169,84	NONSEVERE
40	VA	45	FEMALE	7290	0,21	193000	1530,9	3,33	126,07	NONSEVERE
41	WB	38	MALE	5800	0,15	205000	870	5	235,63	SEVERE
42	WS	28	FEMALE	10700	0,16	161000	1712	4,63	94,04	NONSEVERE
43	YA	53	FEMALE	7100	0,22	233000	1562	3,18	149,17	SEVERE
44	YG	27	FEMALE	7400	0,25	204000	1850	2,6	110,27	NONSEVERE
45	YA	27	FEMALE	5100	0,33	296000	1683	1,61	175,88	NONSEVERE
46	Y	54	FEMALE	5700	0,32	262000	1824	1,84	143,64	NONSEVERE
47	YD	88	MALE	5000	0,25	178000	1250	2,48	142,4	NONSEVERE
48	ZM	25	FEMALE	5400	0,51	260000	2754	0,78	94,41	NONSEVERE
49	ZF	24	FEMALE	10820	0,25	382000	2705	2,52	141,22	NONSEVERE
50	ZJ	69	MALE	19200	0,03	254000	576	30	440,97	SEVERE
51	AY	33	FEMALE	4900	0,38	309000	1862	1,55	165,95	NONSEVERE
52	A	62	MALE	8700	0,15	176000	1305	5,07	134,87	SEVERE
53	AN	50	FEMALE	2900	0,13	281000	1547	6,15	181,64	SEVERE
54	AL	29	FEMALE	11900	0,31	302000	1891	1,81	159,7	NONSEVERE
55	A	60	MALE	7200	0,2	149000	1120	3,2	133,04	NONSEVERE
56	AD	77	MALE	6100	0,3	218000	1140	2	191,23	SEVERE
57	AB	27	MALE	5600	0,23	150000	920	2,83	163,04	NONSEVERE
58	AP	26	MALE	3800	0,27	137000	1107	2,26	123,76	NONSEVERE
59	AM	36	MALE	4000	0,18	143000	1080	4,22	132,41	SEVERE
60	A	62	MALE	4100	0,33	157000	1155	1,61	135,93	NONSEVERE
61	A	71	FEMALE	6000	0,24	137000	1008	2,75	135,91	NONSEVERE
62	A	57	MALE	3500	0,24	208000	2280	2,92	91,23	NONSEVERE
63	AI	26	FEMALE	4200	0,32	296000	2528	1,94	117,09	NONSEVERE
64	AB	28	FEMALE	9500	0,26	293000	2600	2,54	112,69	NONSEVERE
65	A	44	FEMALE	7900	0,22	143000	1408	2,95	101,56	NONSEVERE
66	AS	29	FEMALE	10000	0,11	224000	1012	7,45	221,34	SEVERE
67	AI	17	FEMALE	6400	0,26	192000	1092	2,46	175,82	NONSEVERE
68	A	77	MALE	9200	0,18	192000	990	3,89	193,94	NONSEVERE
69	AA	56	MALE	4200	0,09	131000	747	9,22	175,37	NONSEVERE
70	AP	9	FEMALE	5500	0,42	139000	1260	1,05	110,32	NONSEVERE
71	AU	31	FEMALE	8300	0,26	280000	2002	2,5	139,86	NONSEVERE
72	A	68	MALE	3000	0,1	160000	660	7,8	242,42	SEVERE
73	D	63	FEMALE	7700	0,23	262000	1587	2,91	165,09	NONSEVERE
74	D	51	FEMALE	6600	0,18	270000	1080	3,89	250	SEVERE
75	DN	60	MALE	6900	0,1	283000	1120	8,5	252,68	SEVERE
76	DR	61	FEMALE	6000	0,25	271000	1200	2,52	225,83	NONSEVERE
77	ED	33	FEMALE	11200	0,23	180000	1955	3,04	92,07	NONSEVERE
78	EE	27	FEMALE	4800	0,23	453000	2277	2,96	198,95	NONSEVERE
79	ER	56	FEMALE	8500	0,4	185000	1720	1,2	107,56	NONSEVERE
80	EY	61	FEMALE	9900	0,37	323000	2590	1,38	124,71	NONSEVERE
81	E	72	FEMALE	4300	0,29	308000	1914	2,03	160,92	NONSEVERE
82	ES	53	FEMALE	7000	0,26	169000	1144	2,42	147,73	SEVERE
83	EL	56	FEMALE	6600	0,15	205000	750	4,73	273,33	NONSEVERE
84	EY	41	FEMALE	4400	0,25	298000	1975	2,72	150,89	NONSEVERE
85	ES	49	FEMALE	5000	0,33	142000	1188	1,7	119,53	NONSEVERE
86	E	61	MALE	7900	0,19	187000	1178	3,68	158,74	NONSEVERE
87	ER	61	FEMALE	3600	0,37	157000	1554	1,35	101,26	SEVERE
88	E	57	FEMALE	6200	0,22	578000	1122	2,91	515,15	NONSEVERE
89	E	56	FEMALE	4200	0,3	215000	1950	1,97	110,26	NONSEVERE
90	EA	70	FEMALE	5100	0,22	173000	1650	3,18	104,85	NONSEVERE
91	F	63	MALE	6500	0,06	185000	480	14,67	385,42	SEVERE
92	FA	22	FEMALE	7500	0,29	242000	928	2,03	260,78	NONSEVERE
93	FR	3	FEMALE	8000	0,45	430000	3195	1,16	134,59	NONSEVERE
94	FM	25	FEMALE	3200	0,48	173000	2208	0,83	78,35	NONSEVERE
95	FP	10	FEMALE	7100	0,45	212000	2205	0,96	96,15	NONSEVERE
96	FY	55	FEMALE	4600	0,23	182000	966	2,78	188,41	SEVERE
97	FL	24	FEMALE	4900	0,03	255000	8460	29	30,14	NONSEVERE
98	F	35	FEMALE	4200	0,12	175000	804	6,5	217,66	NONSEVERE
99	GO	63	MALE	282000	0,16	148000	944	4,63	156,78	SEVERE
100	GP	29	MALE	6700	0,26	236000	2080	2,5	113,46	SEVERE
101	G	56	MALE	5900	0,18	324000	882	4,28	367,35	SEVERE
102	GA	59	FEMALE	8000	0,24	127000	984	2,83	129,07	NONSEVERE
103	MD	62	MALE	4900	0,1	198000	590	8	335,59	NONSEVERE
104	HI	62	FEMALE	4100	0,41	171000	902	1,12	189,58	NONSEVERE
105	HN	65	MALE	5900	0,17	129000	1122	4,41	114,97	NONSEVERE
106	HB	44	MALE	2200	0,12	202000	852	6,67	237,09	NONSEVERE
107	HA	66	MALE	6600	0,25	151000	1325	2,6	113,96	NONSEVERE
108	H	36	FEMALE	7100	0,23	343000	2967	2,96	115,6	NONSEVERE
109	H	38	MALE	5300	0,21	93000	1386	3,1	67,1	NONSEVERE
110	HI	21	FEMALE	12900	0,27	151000	1755	2,52	86,04	NONSEVERE
111	I	39	MALE	6600	0,33	243000	1980	1,67	112,73	NONSEVERE
112	IR	24	MALE	6500	0,41	183000	2050	1,1	89,27	NONSEVERE
113	IT	57	MALE	6000	0,16	295000	1216	4,75	242,6	SEVERE
114	IC	59	FEMALE	5000	0,35	296000	3010	1,57	98,34	NONSEVERE
115	IC	67	MALE	7600	0,27	154000	1323	2,41	116,4	NONSEVERE
116	IR	38	FEMALE	8600	0,44	164000	1672	0,91	98,09	NONSEVERE
117	I	52	FEMALE	4900	0,12	162000	1176	6,67	137,76	NONSEVERE
118	IK	52	MALE	3800	0,14	129000	546	5,71	236,26	SEVERE
119	JI	79	MALE	9800	0,43	208000	1333	1,05	156,04	NONSEVERE
120	J	28	MALE	3900	0,42	343000	4578	1,19	74,92	NONSEVERE
121	K	50	FEMALE	3100	0,21	427000	1050	3,33	406,67	NONSEVERE
122	KA	25	MALE	10900	0,3	284000	1530	2	185,62	NONSEVERE
123	K	59	MALE	5000	0,23	269000	920	2,87	292,39	NONSEVERE
124	KF	24	FEMALE	5100	0,06	233000	714	15	326,33	NONSEVERE
125	KG	76	MALE	4000	0,15	179000	1350	5,33	132,59	SEVERE
126	LD	21	FEMALE	11900	0,4	132000	1000	1,2	132	NONSEVERE
127	LN	21	FEMALE	9000	0,2	372000	2160	3,4	172,22	NONSEVERE
128	LS	39	FEMALE	2500	0,2	361000	1240	3,35	291,13	NONSEVERE
129	LA	21	FEMALE	10800	0,19	120000	950	3,84	126,32	NONSEVERE
130	LS	61	FEMALE	6200	0,17	233000	867	4,12	268,74	NONSEVERE
131	LA	27	FEMALE	5000	0,26	338000	1976	2,5	171,05	NONSEVERE
132	MJ	59	MALE	5100	0,12	223000	912	6,25	244,52	NONSEVERE
133	MM	66	FEMALE	7600	0,25	385000	2700	2,6	142,59	NONSEVERE
134	M	45	FEMALE	7600	0,18	394000	1692	4	232,86	SEVERE
135	MZ	65	MALE	10800	0,24	160000	1008	2,67	158,73	NONSEVERE
136	M	37	FEMALE	9400	0,25	352000	1500	2,56	234,67	NONSEVERE
137	MS	54	FEMALE	4200	0,07	319000	1015	12,86	314,29	SEVERE
138	M	54	FEMALE	6000	0,1	232000	1160	8,4	200	SEVERE
139	MF	48	MALE	14500	0,08	345000	712	10,75	484,55	SEVERE
140	M	58	FEMALE	11600	0,27	264000	1593	2,33	165,73	NONSEVERE
141	MR	67	FEMALE	8900	0,1	468000	640	7,5	731,25	SEVERE
142	MN	68	MALE	5900	0,1	261000	1190	8,5	219,33	NONSEVERE
143	ML	21	FEMALE	6400	0,14	195000	630	5,71	309,52	NONSEVERE
144	NA	53	FEMALE	11900	0,35	305000	2485	1,66	122,74	NONSEVERE
145	NL	29	FEMALE	4500	0,27	246000	1917	2,52	128,33	NONSEVERE
146	N	61	FEMALE	7100	0,16	150000	1744	4,88	86,01	SEVERE
147	N	67	MALE	7100	0,3	153000	1590	1,93	96,23	SEVERE
148	NN	69	MALE	10900	0,38	270000	2622	1,32	102,97	NONSEVERE
149	NP	30	MALE	5300	0,32	171000	1568	1,75	109,06	NONSEVERE
150	N	64	FEMALE	6900	0,2	248000	1540	3,35	161,04	NONSEVERE
151	N	71	FEMALE	4900	0,25	200000	1525	2,8	131,15	SEVERE
152	N	61	FEMALE	7700	0,15	234000	1080	5,07	216,67	SEVERE
153	N	61	FEMALE	6100	0,23	222000	1288	2,96	172,36	SEVERE
154	NO	26	FEMALE	7200	0,1	219000	920	8,1	238,04	NONSEVERE
155	N	57	MALE	5600	0,11	202000	1023	7,27	197,46	SEVERE
156	OH	26	FEMALE	9200	0,18	295000	1494	3,89	197,46	NONSEVERE
157	PY	37	MALE	9300	0,03	139000	153	19,67	908,5	NONSEVERE
158	PA	26	MALE	8300	0,22	219000	1342	3	163,19	NONSEVERE
159	PS	8	FEMALE	5100	0,44	402000	2640	1,09	152,27	NONSEVERE
160	R	71	FEMALE	6100	0,5	220000	1850	0,7	118,92	NONSEVERE
161	R	58	MALE	6000	0,24	179000	1536	2,63	116,54	NONSEVERE
162	RA	28	FEMALE	3700	0,16	278000	1248	4,63	222,76	NONSEVERE
163	RF	23	FEMALE	6400	0,38	215000	1786	1,29	120,38	NONSEVERE
164	R	54	MALE	7800	0,13	215000	962	6,31	223,49	SEVERE
165	RM	1	FEMALE	4700	0,44	341000	3696	1,05	92,26	NONSEVERE
166	RA	24	FEMALE	7400	0,18	254000	1872	3,89	135,68	NONSEVERE
167	RP	24	FEMALE	8400	0,18	185000	1404	3,94	131,77	NONSEVERE
168	R	91	FEMALE	10400	0,15	353000	930	4,92	379,57	SEVERE
169	RJ	25	FEMALE	7800	0,23	195000	1725	3,04	113,04	NONSEVERE
170	RR	29	MALE	6200	0,58	198000	2378	0,57	83,26	NONSEVERE
171	RL	25	FEMALE	7500	0,55	247000	1595	0,6	154,86	NONSEVERE
172	R	58	MALE	4100	0,26	121000	1534	2,5	78,88	SEVERE
173	RA	16	FEMALE	2900	0,44	275000	3608	1,2	76,22	NONSEVERE
174	RA	28	FEMALE	5900	0,26	277000	1690	2,31	163,91	NONSEVERE
175	RD	32	FEMALE	8200	0,13	160000	741	5,85	215,92	SEVERE
176	R	72	FEMALE	6500	0,27	267000	1512	2,26	176,59	SEVERE
177	R	65	FEMALE	5700	0,22	147000	924	3,32	159,09	SEVERE
178	SM	72	FEMALE	5600	0,36	260000	3384	1,39	76,83	NONSEVERE
179	SM	62	FEMALE	4200	0,39	89000	1599	1,28	55,66	NONSEVERE
180	S	47	FEMALE	9400	0,28	111000	1680	2,18	66,07	SEVERE
181	SR	71	FEMALE	4100	0,14	149000	714	5	208,68	NONSEVERE
182	SY	24	FEMALE	6000	0,1	248000	1180	8,3	210,17	SEVERE
183	SA	37	MALE	5100	0,48	254000	3024	0,83	83,99	NONSEVERE
184	SA	24	FEMALE	11800	0,11	213000	1122	7,27	189,84	SEVERE
185	SS	44	FEMALE	6300	0,39	156000	2067	1,28	75,47	NONSEVERE
186	SM	94	MALE	10200	0,3	107000	1620	2	66,05	NONSEVERE
187	S	64	FEMALE	5300	0,16	139000	1072	4,63	129,66	SEVERE
188	SP	51	MALE	5400	0,13	386000	1274	6,31	302,98	SEVERE
189	SM	21	MALE	6700	0,34	199000	1462	1,53	136,11	NONSEVERE
190	S	49	MALE	9800	0,27	110000	1971	2,52	55,81	NONSEVERE
191	SP	27	FEMALE	4300	0,21	98000	1638	3,48	59,83	NONSEVERE
192	S	67	MALE	7300	0,24	176000	1200	2,75	146,67	NONSEVERE
193	S	57	MALE	7800	0,02	164000	536	45	305,97	SEVERE
194	S	74	MALE	5000	0,06	599000	732	14,33	818,31	SEVERE
195	SB	48	MALE	26800	0,18	143000	1422	3,89	100,56	SEVERE
196	TW	31	FEMALE	12200	0,32	234000	1760	1,69	132,95	NONSEVERE
197	VW	26	FEMALE	7900	0,13	178000	520	5,69	342,31	NONSEVERE
198	W	47	MALE	5500	0,42	106000	1428	1,1	74,23	SEVERE
199	WS	27	FEMALE	4000	0,47	287000	3995	0,87	71,84	NONSEVERE
200	YJ	66	MALE	3400	0,1	167000	670	7,7	249,25	SEVERE
201	Y	45	FEMALE	8500	0,38	217000	1900	1,47	114,21	NONSEVERE
202	Y	63	MALE	6700	0,2	222000	1620	3,8	137,04	NONSEVERE
203	Y	63	MALE	5000	0,35	222000	1715	1,51	129,45	NONSEVERE
204	YY	50	FEMALE	8100	0,35	253000	2380	1,69	106,3	NONSEVERE
205	YE	52	MALE	4900	0,3	122000	1200	1,97	101,67	NONSEVERE
206	YR	65	MALE	6800	0,25	215000	1200	2,4	179,17	NONSEVERE
207	YM	59	MALE	4000	0,17	139000	714	4,24	194,68	SEVERE
208	YA	66	FEMALE	4800	0,16	242000	736	4,63	328,8	NONSEVERE
209	YM	71	MALE	4200	0,22	287000	1166	3,05	246,14	NONSEVERE
210	ZD	21	FEMALE	4600	0,44	202000	1496	1,02	135,03	NONSEVERE
211	Z	55	MALE	5300	0,25	306000	1025	2,64	298,54	SEVERE
212	ZZ	64	MALE	3400	0,06	147000	444	13,67	331,44	SEVERE
213	ZA	74	FEMALE	4100	0,33	233000	1683	1,67	138,44	NONSEVERE
214	ZK	68	MALE	7400	0,02	234000	360	46	650	SEVERE
215	SY	51	FEMALE	5100	0,06	208000	330	10,33	630,3	SEVERE
216	MY	60	FEMALE	18000	0,09	237000	765	9,89	309,8	SEVERE
217	A	69	FEMALE	4300	0,22	119000	946	2,09	125,79	NONSEVERE
218	H	38	MALE	7100	0,27	453000	1917	2,26	236,31	NONSEVERE
219	R	56	FEMALE	3300	0,36	100000	1188	1,33	84,18	NONSEVERE
220	BF	29	MALE	6100	0,34	228000	2074	1,47	109,93	NONSEVERE
221	MF	28	MALE	7400	0,14	305000	1036	5,71	294,4	NONSEVERE
222	AS	36	FEMALE	7100	0,13	215000	923	6,23	232,94	SEVERE
223	Y	87	FEMALE	6300	0,18	257000	1134	4,28	226,63	SEVERE
224	I	65	MALE	41600	0,03	434000	1248	28,67	347,76	SEVERE
225	J	50	MALE	6500	0,06	204000	390	14	532,08	NONSEVERE
226	Z	48	MALE	11700	0,03	282000	351	29,33	803,42	SEVERE
227	HP	63	MALE	6000	0,05	104000	300	16,4	346,67	SEVERE
228	ZC	48	MALE	7300	0,18	87000	1314	3,89	66,21	NONSEVERE
229	Y	55	MALE	88700	0,03	77000	2661	20	28,94	SEVERE
230	BR	70	MALE	12500	0,1	615000	1250	8	492	SEVERE
231	E	59	FEMALE	8700	0,3	609000	2610	1,87	233,33	SEVERE
232	SY	24	FEMALE	11800	0,1	248000	1180	8,3	210,17	NONSEVERE
233	J	69	FEMALE	12000	0,06	448000	720	14	622,22	SEVERE
234	JD	63	MALE	13000	0,06	208000	780	14,17	266,67	SEVERE
235	YS	27	FEMALE	11400	0,13	171000	1482	6,15	115,38	NONSEVERE
236	A	68	FEMALE	6500	0,32	217000	2080	1,75	104,33	NONSEVERE
237	E	57	MALE	12100	0,1	354000	1210	8	292,56	SEVERE
238	HY	21	FEMALE	7900	0,14	628000	1106	5	567,81	NONSEVERE
239	MM	64	MALE	6700	0,18	102000	1206	4,11	84,58	NONSEVERE
240	MY	31	FEMALE	15000	0,03	518000	450	30	1151,11	SEVERE
241	FY	31	FEMALE	6700	0,15	279000	1005	5	277,61	NONSEVERE

242	YI	62	MALE	7900	0,17	257000	1343	4,18	191,36	SEVERE
243	LS	44	FEMALE	185000	0,07	269000	12950	12,29	20,77	NONSEVERE
244	M	61	MALE	9800	0,11	347000	1078	7	321,89	SEVERE
245	F	41	FEMALE	8000	0,16	147000	1280	4,81	114,84	SEVERE
246	R	57	FEMALE	3300	0,33	232000	1089	1,67	213,04	NONSEVERE
247	NM	73	MALE	48400	0,06	53000	2904	9,33	18,25	NONSEVERE
248	ED	33	FEMALE	7400	0,09	224000	666	9,56	336,34	SEVERE
249	D	60	FEMALE	16800	0,09	198000	1512	8,89	130,95	SEVERE
250	A	32	FEMALE	4500	0,17	137000	765	4,47	179,08	NONSEVERE
251	Y	67	FEMALE	7400	0,11	175000	814	7,36	214,99	SEVERE
252	A	70	MALE	13300	0,02	272000	266	46	1022,56	SEVERE
253	M	54	FEMALE	11600	0,1	232000	1160	8,4	200	SEVERE
254	FA	48	FEMALE	10600	0,1	357000	1060	8	336,79	NONSEVERE
255	Y	62	FEMALE	12900	0,06	379000	774	14,5	489,66	SEVERE
256	D	66	FEMALE	6000	0,18	182000	1080	3,89	168,52	SEVERE
257	K	47	MALE	7900	0,25	256000	1975	2	129,62	NONSEVERE
258	E	55	FEMALE	5300	0,24	200000	1272	2,75	157,23	NONSEVERE
259	RD	32	FEMALE	5700	0,13	160000	741	5,85	215,92	NONSEVERE
260	R	50	FEMALE	4800	0,25	384000	1200	2,44	320	SEVERE
261	KY	60	FEMALE	5900	0,23	242000	1357	3,04	178,33	NONSEVERE
262	A	63	MALE	8300	0,14	176000	1162	3,79	151,46	NONSEVERE
263	M	67	MALE	6100	0,06	195000	366	14	532,79	SEVERE
264	M	70	MALE	12300	0,11	274000	1353	7,27	202,51	SEVERE
265	A	51	MALE	6000	0,25	203000	1500	2,6	135,33	NONSEVERE
266	Y	64	FEMALE	5600	0,18	279000	1008	3,89	276,79	NONSEVERE
267	SD	33	FEMALE	9500	0,1	223000	950	7,2	234,74	NONSEVERE
268	PF	20	FEMALE	4000	0,52	218000	2080	0,67	104,81	NONSEVERE
269	AG	32	FEMALE	5200	0,2	169000	1040	3,65	162,5	NONSEVERE
270	NF	48	FEMALE	5900	0,15	251000	885	5,13	283,62	SEVERE
271	DH	44	FEMALE	13000	0,06	356000	780	14	456,41	SEVERE
272	S	57	MALE	26800	0,02	168000	536	40	313,43	SEVERE
273	HA	35	MALE	3700	0,22	151000	814	3,05	185,5	NONSEVERE
274	VA	27	FEMALE	14700	0,13	353000	1911	5,77	184,72	NONSEVERE
275	N	52	FEMALE	6400	0,11	335000	704	7,36	475,85	SEVERE
276	A	70	FEMALE	8900	0,2	233000	1780	3,55	130,9	NONSEVERE
277	B	75	FEMALE	11800	0,08	219000	944	10,25	231,99	SEVERE
278	WR	32	FEMALE	6300	0,17	200000	1071	4,29	186,74	NONSEVERE
279	BY	66	FEMALE	14500	0,03	428000	435	30,67	983,91	SEVERE
280	YK	43	FEMALE	8900	0,02	131000	178	43	735,96	SEVERE
281	K	74	FEMALE	9000	0,08	416000	720	10,75	577,78	SEVERE
282	MN	31	FEMALE	7900	0,14	289000	1106	5,71	261,3	SEVERE
283	RP	29	MALE	6100	0,22	274000	1342	2,95	204,17	NONSEVERE
284	MN	64	MALE	5600	0,22	197000	1232	2,91	159,9	NONSEVERE
285	RA	35	FEMALE	17700	0,04	204000	708	21,75	288,14	NONSEVERE
286	S	74	FEMALE	2700	0,35	104000	945	1,49	110,05	NONSEVERE
287	DM	55	FEMALE	8200	0,12	164000	984	7,33	166,67	NONSEVERE
288	AN	63	FEMALE	5500	0,28	258000	1540	2,11	167,53	NONSEVERE
289	J	65	FEMALE	9600	0,11	127000	1056	7,36	120,27	SEVERE

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	2,8	2,8	2,8
	2	34	11,8	11,8	14,5
	3	82	28,4	28,4	42,9
	4	41	14,2	14,2	57,1
	5	72	24,9	24,9	82,0
	6	52	18,0	18,0	100,0
	Total	289	100,0	100,0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	111	38,4	38,4	38,4
	Female	178	61,6	61,6	100,0
	Total	289	100,0	100,0	

Leukocyte

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	14	4,8	4,8	4,8
	2,00	225	77,9	77,9	82,7
	3,00	50	17,3	17,3	100,0
	Total	289	100,0	100,0	

Thrombocyte

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	47	16,3	16,3	16,3
	2,00	233	80,6	80,6	96,9
	3,00	9	3,1	3,1	100,0
	Total	289	100,0	100,0	

Severity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Nonsevere	190	65,7	65,7	65,7
	Severe	99	34,3	34,3	100,0
	Total	289	100,0	100,0	

Univariate Test

Bivariate Test

NLR * Severity Crosstabulation

Count

		Severity		Total
		Nonsevere	Severe	
NLR	< 3,54	134	20	154
	> 3,53	56	79	135
Total		190	99	289

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	66,220(b)	1	,000		
Continuity Correction(a)	64,213	1	,000		
Likelihood Ratio	69,349	1	,000		
Fisher's Exact Test				,000	,000
Linear-by-Linear Association	65,991	1	,000		
N of Valid Cases	289				

a Computed only for a 2x2 table

b 0 cells (,0%) have expected count less than 5. The minimum expected count is 46,25.

PLR * Severity Crosstabulation

Count

		Severity		Total
		Nonsevere	Severe	
PLR	< 181	139	27	166
	> 180	51	72	123
Total		190	99	289

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	56,055(b)	1	,000		
Continuity Correction(a)	54,194	1	,000		
Likelihood Ratio	57,160	1	,000		
Fisher's Exact Test				,000	,000
Linear-by-Linear Association	55,862	1	,000		
N of Valid Cases	289				

a Computed only for a 2x2 table

b 0 cells (,0%) have expected count less than 5. The minimum expected count is 42,13.

CONCLUSION

There was a significant correlation between NLR and PLR with severity of COVID-19 inpatients. Increase NLR and PLR value can be used as a marker to assess the prognosis and severity of patients. NLR and PLR examinations need to be done at the beginning of hospitalization so that treatment can be done as early as possible.

FINANCIAL SUPPORT

Nothing.

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CONFLICT OF INTEREST

Nothing.

DAFTAR PUSTAKA

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